

LM741 Operational Amplifier

Check for Samples: [LM741](#)

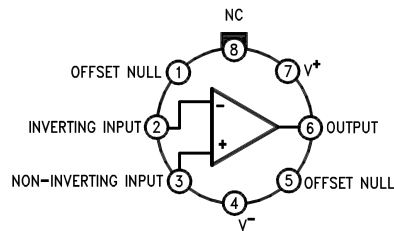
DESCRIPTION

The LM741 series are general purpose operational amplifiers which feature improved performance over industry standards like the LM709. They are direct, plug-in replacements for the 709C, LM201, MC1439 and 748 in most applications.

The amplifiers offer many features which make their application nearly foolproof: overload protection on the input and output, no latch-up when the common mode range is exceeded, as well as freedom from oscillations.

The LM741C is identical to the LM741/LM741A except that the LM741C has their performance guaranteed over a 0°C to +70°C temperature range, instead of –55°C to +125°C.

Connection Diagram



LM741H is available per JM38510/10101

Figure 1. Metal Can Package

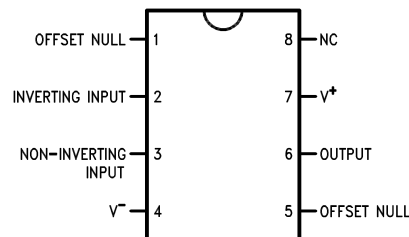


Figure 2. Dual-In-Line or S.O. Package

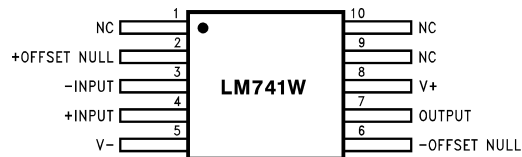
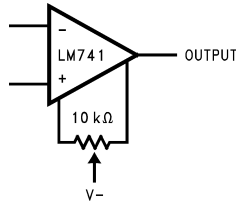


Figure 3. Ceramic Flatpak

Typical Application

SNOO29B-MR-2004 REVISED OCTOBER 2004

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Figure 4. Offset Nulling Circuit


These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Absolute Maximum Ratings ^{(1) (2)}

	LM741A	LM741	LM741C
Supply Voltage	±22V	±22V	±18V
Power Dissipation ⁽³⁾	500 mW	500 mW	500 mW
Differential Input Voltage	±30V	±30V	±30V
Input Voltage ⁽⁴⁾	±15V	±15V	±15V
Output Short Circuit Duration	Continuous	Continuous	Continuous
Operating Temperature Range	-55°C to +125°C	-55°C to +125°C	0°C to +70°C
Storage Temperature Range	-65°C to +150°C	-65°C to +150°C	-65°C to +150°C
Junction Temperature	150°C	150°C	100°C
Soldering Information			
N-Package (10 seconds)	260°C	260°C	260°C
J- or H-Package (10 seconds)	300°C	300°C	300°C
M-Package			
Vapor Phase (60 seconds)	215°C	215°C	215°C
Infrared (15 seconds)	215°C	215°C	215°C
See AN-450 "Surface Mounting Methods and Their Effect on Product Reliability" for other methods of soldering surface mount devices.			
ESD Tolerance ⁽⁵⁾	400V	400V	400V

- (1) "Absolute Maximum Ratings" indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits.
- (2) For military specifications see RETS741X for LM741 and RETS741AX for LM741A.
- (3) For operation at elevated temperatures, these devices must be derated based on thermal resistance, and T_j max. (listed under "Absolute Maximum Ratings"). $T_j = T_A + (\theta_{JA} P_D)$.
- (4) For supply voltages less than ±15V, the absolute maximum input voltage is equal to the supply voltage.
- (5) Human body model, 1.5 kΩ in series with 100 pF.

Electrical Characteristics ⁽¹⁾

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Parameter	Conditions	LM741A			LM741			LM741C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$T_A = 25^\circ\text{C}$										
	$R_S \leq 10\text{ k}\Omega$					1.0	5.0		2.0	6.0	mV
	$R_S \leq 50\Omega$		0.8	3.0							mV
	$T_{AMIN} \leq T_A \leq T_{AMAX}$										
	$R_S \leq 50\Omega$			4.0							mV
	$R_S \leq 10\text{ k}\Omega$						6.0			7.5	mV
Average Input Offset				15							$\mu\text{V}/^\circ\text{C}$
Voltage Drift											
Input Offset Voltage	$T_A = 25^\circ\text{C}, V_S = \pm 20\text{V}$	± 10				± 15			± 15		mV
Adjustment Range											
Input Offset Current	$T_A = 25^\circ\text{C}$		3.0	30		20	200		20	200	nA
	$T_{AMIN} \leq T_A \leq T_{AMAX}$			70		85	500			300	nA
Average Input Offset				0.5							$\text{nA}/^\circ\text{C}$
Current Drift											
Input Bias Current	$T_A = 25^\circ\text{C}$		30	80		80	500		80	500	nA
	$T_{AMIN} \leq T_A \leq T_{AMAX}$			0.210			1.5			0.8	μA
Input Resistance	$T_A = 25^\circ\text{C}, V_S = \pm 20\text{V}$	1.0	6.0		0.3	2.0		0.3	2.0		$\text{M}\Omega$
	$T_{AMIN} \leq T_A \leq T_{AMAX},$	0.5									$\text{M}\Omega$
	$V_S = \pm 20\text{V}$										
Input Voltage Range	$T_A = 25^\circ\text{C}$							± 12	± 13		V
	$T_{AMIN} \leq T_A \leq T_{AMAX}$				± 12	± 13					V
Large Signal Voltage Gain	$T_A = 25^\circ\text{C}, R_L \geq 2\text{ k}\Omega$										
	$V_S = \pm 20\text{V}, V_O = \pm 15\text{V}$	50									V/mV
	$V_S = \pm 15\text{V}, V_O = \pm 10\text{V}$				50	200		20	200		V/mV
	$T_{AMIN} \leq T_A \leq T_{AMAX},$										
	$R_L \geq 2\text{ k}\Omega,$										
	$V_S = \pm 20\text{V}, V_O = \pm 15\text{V}$	32									V/mV
	$V_S = \pm 15\text{V}, V_O = \pm 10\text{V}$				25			15			V/mV
Output Voltage Swing	$V_S = \pm 5\text{V}, V_O = \pm 2\text{V}$	10									V/mV
	$V_S = \pm 20\text{V}$										
	$R_L \geq 10\text{ k}\Omega$	± 16									V
	$R_L \geq 2\text{ k}\Omega$	± 15									V
	$V_S = \pm 15\text{V}$										
	$R_L \geq 10\text{ k}\Omega$				± 12	± 14		± 12	± 14		V
	$R_L \geq 2\text{ k}\Omega$				± 10	± 13		± 10	± 13		V
Output Short Circuit	$T_A = 25^\circ\text{C}$	10	25	35		25			25		mA
Current	$T_{AMIN} \leq T_A \leq T_{AMAX}$	10		40							mA
Common-Mode	$T_{AMIN} \leq T_A \leq T_{AMAX}$										
Rejection Ratio	$R_S \leq 10\text{ k}\Omega, V_{CM} = \pm 12\text{V}$				70	90		70	90		dB
	$R_S \leq 50\Omega, V_{CM} = \pm 12\text{V}$	80	95								dB
Supply Voltage Rejection	$T_{AMIN} \leq T_A \leq T_{AMAX},$										
	Ratio										
	$V_S = \pm 20\text{V}$ to $V_S = \pm 5\text{V}$										
	$R_S \leq 50\Omega$	86	96								dB
	$R_S \leq 10\text{ k}\Omega$				77	96		77	96		dB
Transient Response	$T_A = 25^\circ\text{C}, \text{Unity Gain}$										

(1) Unless otherwise specified, these specifications apply for $V_S = \pm 15\text{V}$, $-55^\circ\text{C} \leq T_A \leq +125^\circ\text{C}$ (LM741/LM741A). For the LM741C/LM741E, these specifications are limited to $0^\circ\text{C} \leq T_A \leq +70^\circ\text{C}$.

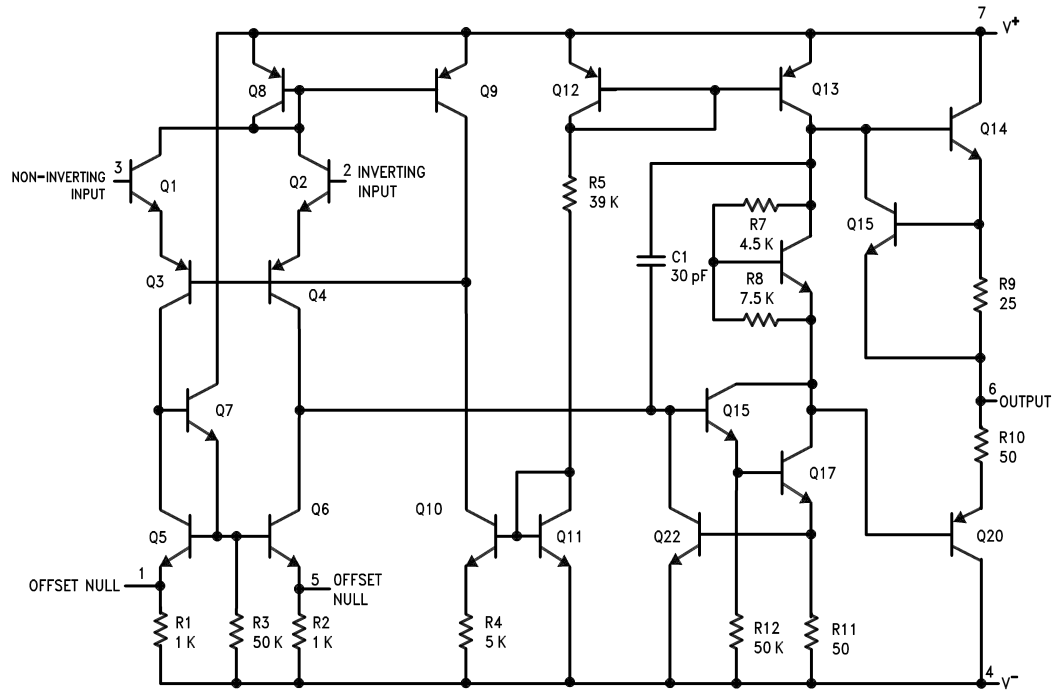
Electrical Characteristics ⁽¹⁾ (continued)
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Parameter	Conditions	LM741A			LM741			LM741C			Units
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Rise Time			0.25	0.8		0.3			0.3		μs
Overshoot			6.0	20		5			5		%
Bandwidth ⁽²⁾	T _A = 25°C	0.437	1.5								MHz
Slew Rate	T _A = 25°C, Unity Gain	0.3	0.7			0.5			0.5		V/μs
Supply Current	T _A = 25°C					1.7	2.8		1.7	2.8	mA
Power Consumption	T _A = 25°C										
	V _S = ±20V		80	150							mW
	V _S = ±15V					50	85		50	85	mW
LM741A	V _S = ±20V										
	T _A = T _{AMIN}			165							mW
	T _A = T _{AMAX}			135							mW
LM741	V _S = ±15V										
	T _A = T _{AMIN}					60	100				mW
	T _A = T _{AMAX}					45	75				mW

(2) Calculated value from: BW (MHz) = 0.35/Rise Time(μs).

www.ti.com	Thermal Resistance	Cerdip (J)	DIP (N)	SNOSC25B-1 MAY 2004 – REVISED OCTOBER 2004	HQ8 (H)	SO8 (M)
	θ_{JA} (Junction to Ambient)	100°C/W	100°C/W		170°C/W	195°C/W
	θ_{JC} (Junction to Case)	N/A	N/A		25°C/W	N/A

Schematic Diagram



PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
LM741CH	ACTIVE	TO-99	LMC	8	500	TBD	POST-PLATE	Level-1-NA-UNLIM	
LM741CH/NOPB	ACTIVE	TO-99	LMC	8	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM741CN	ACTIVE	PDIP	P	8	40	TBD	Call TI	Level-1-NA-UNLIM	
LM741CN/NOPB	ACTIVE	PDIP	P	8	40	Green (RoHS & no Sb/Br)	Call TI	Level-1-NA-UNLIM	
LM741H	ACTIVE	TO-99	LMC	8	500	TBD	POST-PLATE	Level-1-NA-UNLIM	
LM741H/NOPB	ACTIVE	TO-99	LMC	8	500	Green (RoHS & no Sb/Br)	POST-PLATE	Level-1-NA-UNLIM	
LM741J	ACTIVE	CDIP	NAB	8	40	TBD	Call TI	Level-1-NA-UNLIM	
U5B7741312	ACTIVE	TO-99	LMC	8	500	TBD	POST-PLATE	Level-1-NA-UNLIM	
U5B7741393	ACTIVE	TO-99	LMC	8	500	TBD	POST-PLATE	Level-1-NA-UNLIM	
U9T7741393	ACTIVE	PDIP	P	8	40	TBD	Call TI	Level-1-NA-UNLIM	

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

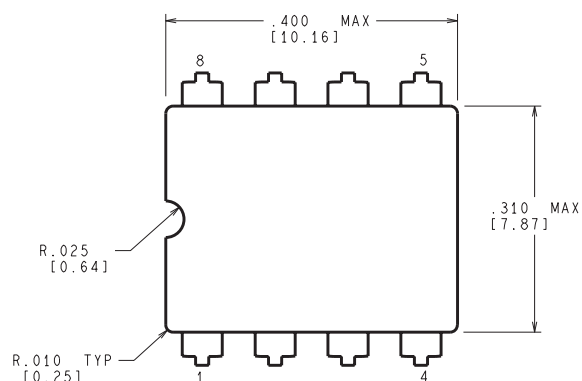
(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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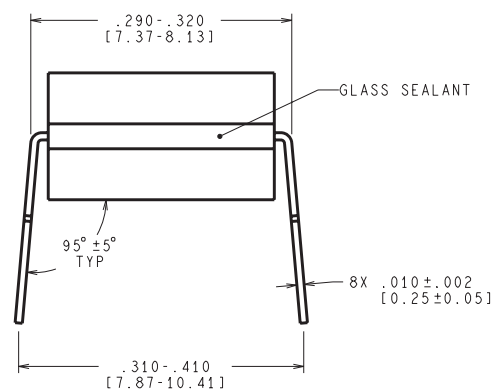
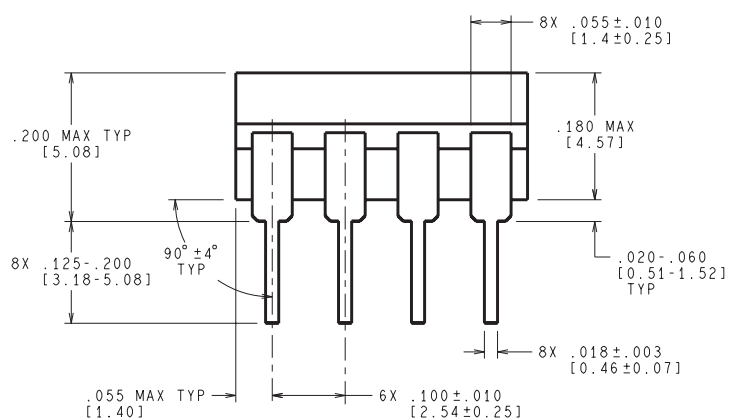
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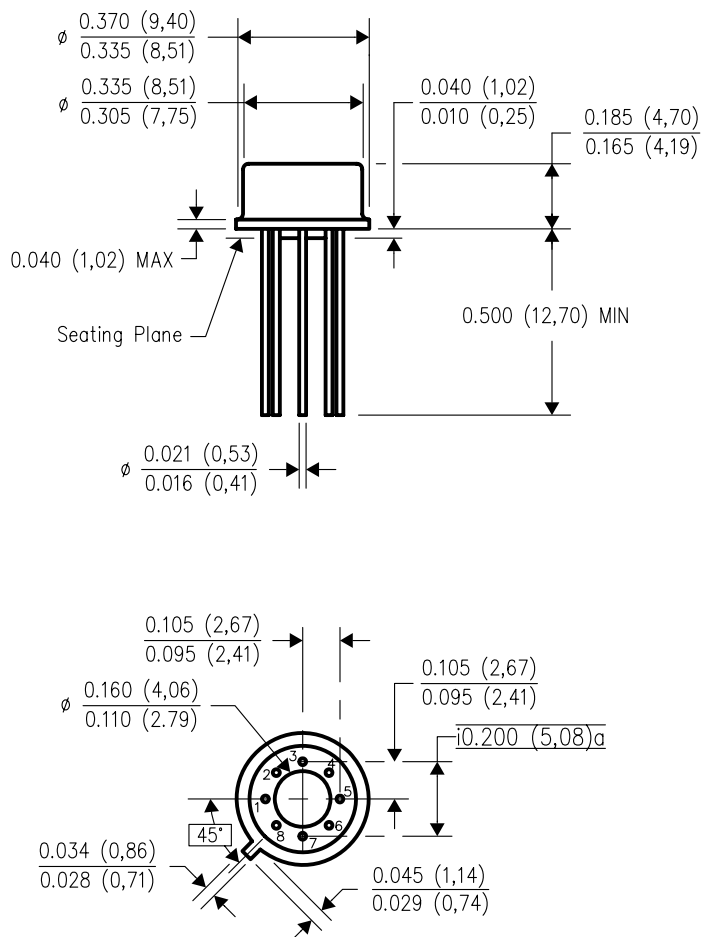
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J08A (Rev M)

LMC (O-MBCY-W8)

METAL CYLINDRICAL PACKAGE



4202483/B 09/07

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Leads in true position within 0.010 (0,25) R @ MMC at seating plane.
 - Pin numbers shown for reference only. Numbers may not be marked on package.
 - Falls within JEDEC MO-002/T0-99.

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



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